CLAIMS

We claim:

1. A transform coder comprising:

a transient detection component operating to process samples of an input signal to identify locations of transients in the input signal;

an open-loop window configuration component operating in response to the identified transient location to configure a first configuration of sizes of a plurality of transform input windows over the input signal selected from at least a small window size, a large window size, and an intermediate window size, so as to place one or more windows of the small window size to encompass a region of the input signal having at least one identified transient location and place windows of the large window size in areas of the input signal having no identified transient locations;

an encoding component for transform coding the input signal according to the first configuration of transform input window sizes, and for decoding to produce a reconstructed signal;

a quality measurement component operating to measure achieved quality of the reconstructed signal; and

a closed-loop window configuration component operating in response to the achieved quality measurement to adjust sizes of the transform input windows in the first configuration according to the achieved quality measurement to produce a second configuration of transform input windows for use in transform coding the input signal.

2. The transform coder of claim 1 wherein the open-loop window configuration component is further operative to place at least one transform input window of the intermediate window size between the transform input windows of the small window size and those of the large window size.

3. The transform coder of claim 1 wherein the closed-loop window configuration component operates to adjust sizes of the transform input windows in a current portion of the input signal according to the achieved quality measurement of a preceding portion of the reconstructed signal.

4. The transform coder of claim 1 wherein:

the quality measurement component further operates to measure achieved perceptual quantization noise of the reconstructed signal for at least some of the transform input windows in the first configuration; and

the closed-loop window configuration component further operates to increase a minimum permitted window size of transform input windows for at least a portion of the input signal where the measure of achieved perceptual quantization noise exceeds an acceptable threshold.

5. The transform coder of claim 4 wherein:

the closed-loop window configuration component also operates to increase a minimum permitted window size of transform input windows for at least a portion of the input signal when utilization of a rate control buffer exceeds a fullness threshold.

6. The transform coder of claim 1 wherein:

the quality measurement component further operates to detect pre-echo in the reconstructed signal; and

the closed-loop window configuration component further operates to decrease window size of at least one transform input window in at least a portion of the input signal where pre-echo is detected.

7. The transform coder of claim 6 wherein said decreasing the window size comprises decomposing a frame in which pre-echo is detected into transform input windows of the small window size.

8. The transform coder of claim 6 wherein said decreasing the window size comprises decomposing a transform input window in the first configuration in which pre-echo is detected into transform input windows of the small window size.

9. In a transform coder, a method of adaptively selecting transform window size, the method comprising:

detecting locations of transients in an input signal;

for a frame of the input signal in which no transient location is detected, configuring size of a transform window to be a first window size;

for a frame of the input signal in which at least one transient location is detected, configuring sizes of a plurality of transform windows in the frame to comprise a consecutive set of at least one second-size window substantially encompassing the transient locations in the frame and at least one third-size window before the transient, where the second window size is smaller than the first window size and where the third window size is intermediate to the first and second window sizes; and

transform encoding the input signal according to a first transform window configuration including the configured sizes of transform windows.

10. The method of claim 9 further comprising:

measuring achieved perceptual quality of the transform-encoded signal;

re-configuring the size of at least some of the transform windows configured in the first transform window configuration according to the measured perceptual quality to produce a second transform window configuration; and

transform encoding the input signal according to the second transform window configuration.

11. The method of claim 9 further comprising:

measuring achieved perceptual quality of the transform-encoded signal for at least some of the configured transform windows;

increasing sizes of at least some transform windows in the first transform window configuration where the achieved perceptual quality of the transform-encoded signal exceeds an acceptable level to produce a second transform window configuration;

transform encoding the input signal according to the second transform window configuration.

12. The method of claim 11 further comprising:

increasing sizes of at least some transform windows in the first transform window configuration to produce the second transform window configuration when utilization of a rate control buffer exceeds a fullness threshold.

13. The method of claim 9 further comprising:

increasing sizes of at least some transform windows in the first transform window configuration to produce a second transform window configuration when utilization of a rate control buffer exceeds a fullness threshold; and

transform encoding the input signal according to the second transform window configuration.

14. The method of claim 9 further comprising:

measuring achieved perceptual quality of the transform-encoded signal for at least some of the configured transform windows;

increasing sizes of transform windows in a frame in the first transform window configuration to an increased minimum size greater than the second window size where the achieved perceptual quality of the transform-encoded signal in the frame exceeds an acceptable level to produce a second transform window configuration;

transform encoding the input signal according to the second transform window configuration.

15. The method of claim 9 further comprising:

detecting pre-echo in the transform-encoded signal;

decreasing sizes of at least some transform windows in the first transform window configuration in a portion of the transform-encoded signal where pre-echo is detected to produce a second transform window configuration;

transform encoding the input signal according to the second transform window configuration.

16. The method of claim 15 wherein measuring pre-echo comprises:

measuring a vector of achieved perceptual quality of a plurality of segments of the transform-encoded signal, the segments being smaller than the second window size;

measuring a global achieved perceptual quality of at least a portion of the transform-encoded signal; and

determining that pre-echo exists at location of the input signal corresponding to components of the achieved perceptual quality in the vector that exceed a significancy multiple of the global achieved perceptual quality.

17. The method of claim 15 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration that form a frame in which pre-echo is detected into minimum size transform windows to produce the second transform window configuration.

18. The method of claim 15 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration in which pre-echo is detected into smaller size windows to produce the second transform window configuration.

19. In a transform coder, a method of adaptively selecting transform window size, the method comprising:

detecting locations of transients in an input signal;

for a frame of the input signal in which no transient location is detected, configuring size of a transform window to be a first window size;

for a frame of the input signal in which at least one transient location is detected, configuring sizes of a plurality of transform windows in the frame to comprise a consecutive set of at least one second-size window substantially encompassing the transient locations in the frame, where the second window size is smaller than the first window size;

transform encoding the input signal according to a first transform window configuration including the configured sizes of transform windows.

measuring achieved perceptual quality of the transform-encoded signal;

re-configuring the size of at least some of the transform windows configured in the first transform window configuration according to the measured perceptual quality to produce a second transform window configuration; and

transform encoding the input signal according to the second transform window configuration.

20. The method of claim 19 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of at least some transform windows in the first transform window configuration where the achieved perceptual quality of the transform-encoded signal exceeds an acceptable level to produce the second transform window configuration.

21. The method of claim 19 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of at least some transform windows in the first transform window configuration to produce the second transform window configuration when utilization of a rate control buffer exceeds a fullness threshold.

22. The method of claim 19 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of transform windows in a frame in the first transform window configuration to an increased minimum size greater than the second window size where the achieved perceptual quality of the transform-encoded signal in the frame exceeds an acceptable level to produce the second transform window configuration.

23. The method of claim 19 further comprising:

detecting pre-echo based on said measuring achieved perceptual quality of the transform-encoded signal; and

decreasing sizes of at least some transform windows in the first transform window configuration in a portion of the transform-encoded signal where pre-echo is detected to produce the second transform window configuration.

24. The method of claim 23 wherein measuring pre-echo comprises:

measuring a vector of achieved perceptual quality of a plurality of segments of the transform-encoded signal, the segments being smaller than the second window size;

measuring a global achieved perceptual quality of at least a portion of the transform-encoded signal; and

determining that pre-echo exists at location of the input signal corresponding to components of the achieved perceptual quality in the vector that exceed a significancy multiple of the global achieved perceptual quality.

25. The method of claim 23 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration that form a frame in which pre-echo is detected into minimum size transform windows to produce the second transform window configuration.

26. The method of claim 23 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration in which pre-echo is detected into smaller size windows to produce the second transform window configuration.

27. In a transform coder, a method of adaptively selecting transform window size, the method comprising:

detecting locations of transients in a current frame of an input signal;

measuring achieved perceptual quality of at least one prior transform-encoded frame of the input signal;

determining a minimal window size for the current frame based on the measured achieved perceptual quality of the at least one prior transform-encoded frame;

for a first case in which no transient location is detected in the current frame, configuring size of a transform window to be a first window size;

for a second case in which at least one transient location is detected in the current frame of the input signal, configuring sizes of a plurality of transform windows in the frame to comprise a consecutive set of at least one second-size window substantially encompassing the transient locations in the frame, where the second window size is the minimal window size for the current frame; and

transform encoding the current frame of the input signal according to the configured sizes of transform windows.

28. The method of claim 27 wherein said determining the minimal window size comprises:

increasing the minimal window size for the current frame if the achieved perceptual quality of the at least one prior transform-encoded frame of the input signal exceeds an acceptable level.

29. The method of claim 19 wherein said determining the minimal window size comprises:

increasing the minimal window size for the current frame if utilization of a rate control buffer exceeds a fullness threshold.

30. The method of claim 19 further comprising:

detecting pre-echo; and

decreasing sizes of at least some transform windows where pre-echo is detected.

31. The method of claim 30 wherein measuring pre-echo comprises:

measuring a vector of achieved perceptual quality of a plurality of segments of the input signal, the segments being smaller than the second window size;

measuring a global achieved perceptual quality of the at least one prior transform-encoded frame; and

determining that pre-echo exists at location of the input signal corresponding to components of the achieved perceptual quality in the vector that exceed a significancy multiple of the global achieved perceptual quality.

32. The method of claim 30 wherein the decreasing sizes comprises:

if pre-echo is detected, decomposing all configured transform windows in the current frame to the minimal window size.

33. The method of claim 30 wherein the decreasing sizes comprises:

decomposing only those configured transform windows in the current frame in which pre-echo is detected to the minimal window size.

34. A program storage medium having a transform coding program executable on an audio processing device to perform a method of adaptively selecting transform window size, the method comprising:

detecting locations of transients in an input signal;

for a frame of the input signal in which no transient location is detected, configuring size of a transform window to be a first window size;

for a frame of the input signal in which at least one transient location is detected, configuring sizes of a plurality of transform windows in the frame to comprise a consecutive set of at least one second-size window substantially encompassing the transient locations in the frame, where the second window size is smaller than the first window size;

transform encoding the input signal according to a first transform window configuration including the configured sizes of transform windows.

measuring achieved perceptual quality of the transform-encoded signal;

re-configuring the size of at least some of the transform windows configured in the first transform window configuration according to the measured perceptual quality to produce a second transform window configuration; and

transform encoding the input signal according to the second transform window configuration.

35. The program storage medium of claim 34 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of at least some transform windows in the first transform window configuration where the achieved perceptual quality of the transform-encoded signal exceeds an acceptable level to produce the second transform window configuration.

36. The program storage medium of claim 34 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of at least some transform windows in the first transform window configuration to produce the second transform window configuration when utilization of a rate control buffer exceeds a fullness threshold.

37. The program storage medium of claim 34 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of transform windows in a frame in the first transform window configuration to an increased minimum size greater than the second window size where the achieved perceptual quality of the transform-encoded signal in the frame exceeds an acceptable level to produce the second transform window configuration.

38. The program storage medium of claim 34 wherein the method further comprises:

detecting pre-echo based on said measuring achieved perceptual quality of the transform-encoded signal; and

decreasing sizes of at least some transform windows in the first transform window configuration in a portion of the transform-encoded signal where pre-echo is detected to produce the second transform window configuration.

39. The program storage medium of claim 38 wherein measuring pre-echo comprises:

measuring a vector of achieved perceptual quality of a plurality of segments of the transform-encoded signal, the segments being smaller than the second window size;

measuring a global achieved perceptual quality of at least a portion of the transform-encoded signal; and

determining that pre-echo exists at location of the input signal corresponding to components of the achieved perceptual quality in the vector that exceed a significancy multiple of the global achieved perceptual quality.

40. The program storage medium of claim 38 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration that form a frame in which pre-echo is detected into minimum size transform windows to produce the second transform window configuration.

41. The program storage medium of claim 38 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration in which pre-echo is detected into smaller size windows to produce the second transform window configuration.

42. A data carrying medium having a transform coded signal carried thereon produced according to a method comprising:

detecting locations of transients in an input signal;

for a frame of the input signal in which no transient location is detected, configuring size of a transform window to be a first window size;

for a frame of the input signal in which at least one transient location is detected, configuring sizes of a plurality of transform windows in the frame to comprise a consecutive set of at least one second-size window substantially encompassing the

transient locations in the frame, where the second window size is smaller than the first window size;

transform encoding the input signal according to a first transform window configuration including the configured sizes of transform windows.

measuring achieved perceptual quality of the transform-encoded signal;

re-configuring the size of at least some of the transform windows configured in the first transform window configuration according to the measured perceptual quality to produce a second transform window configuration; and

transform encoding the input signal according to the second transform window configuration.

43. The data carrying medium of claim 42 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of at least some transform windows in the first transform window configuration where the achieved perceptual quality of the transform-encoded signal exceeds an acceptable level to produce the second transform window configuration.

44. The data carrying medium of claim 42 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of at least some transform windows in the first transform window configuration to produce the second transform window configuration when utilization of a rate control buffer exceeds a fullness threshold.

45. The data carrying medium of claim 42 wherein said re-configuring the size of at least some of the transform windows comprises:

increasing sizes of transform windows in a frame in the first transform window configuration to an increased minimum size greater than the second window size where the achieved perceptual quality of the transform-encoded signal in the frame exceeds an acceptable level to produce the second transform window configuration.

46. The data carrying medium of claim 42 wherein the method further comprises:

detecting pre-echo based on said measuring achieved perceptual quality of the transform-encoded signal; and

decreasing sizes of at least some transform windows in the first transform window configuration in a portion of the transform-encoded signal where pre-echo is detected to produce the second transform window configuration.

47. The data carrying medium of claim 46 wherein measuring pre-echo comprises:

measuring a vector of achieved perceptual quality of a plurality of segments of the transform-encoded signal, the segments being smaller than the second window size;

measuring a global achieved perceptual quality of at least a portion of the transform-encoded signal; and

determining that pre-echo exists at location of the input signal corresponding to components of the achieved perceptual quality in the vector that exceed a significancy multiple of the global achieved perceptual quality.

48. The data carrying medium of claim 46 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration that form a frame in which pre-echo is detected into minimum size transform windows to produce the second transform window configuration.

49. The data carrying medium of claim 46 wherein decreasing sizes of at least some transform windows in the first window configuration comprises:

decomposing configured transform windows in the first window configuration in which pre-echo is detected into smaller size windows to produce the second transform window configuration.